

## PERFORMANCE ASSESSMENT OF COTTON CULTIVARS AGAINST POPULATION DYNAMICS OF *BEMISIA TABACI* AND *THRIPS TABACI*

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### Abstract

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This study was conducted to evaluate the performance of cotton cultivars in response to population fluctuation of *Bemisia tabaci* and *Thrips tabaci* in field under Randomized Complete Block Design. Two transgenic cotton cultivars (FH-114 and FH-901) and two conventional cotton cultivars (FH-1000 and CIM-496) were used during this study, respectively. According to the results, Maximum susceptibility for both tested insect pests infestation was found in case of transgenic cotton cultivars as compared to conventional cotton cultivars. Highly significant variations were observed in *B. tabaci* and *T. tabaci*/leaf pooled comparison on different tested cotton cultivars. Maximum populations of *B. tabaci* (5.21 *B. tabaci*/leaf) and *T. tabaci* (4.47 *T. tabaci*/leaf) were observed on FH-114, whereas low level of infestation of *B. tabaci* (3.75 *B. tabaci*/leaf) and *T. tabaci* (3.31 *T. tabaci*/leaf) were observed on CIM-496. When data were statistically analyzed, higher level of *B. tabaci* and *T. tabaci* (5.19 *B. tabaci* and 4.46 *T. tabaci*/leaf, respectively) was observed on transgenic cotton as compared to conventional cotton cultivars (3.76 *B. tabaci* and 3.33 *T. tabaci*/leaf).

**Key words:** *Bemisia tabaci*, *Thrips tabaci*, population fluctuation, transgenic and conventional cotton cultivars

### Introduction

Cotton (*Gossypium* spp.) is the king of natural fiber and grown in more than 111 countries throughout the world (Anonymous, 2005). It is not only the major cash crop but also each and every part of cotton plant is useful in one or many ways to farmer (Shivanna et al., 2009). About 150 different insect and mite pests' species are attacked on cotton and are the major reason of yield and quality reduction of cotton (Attique and Rashid, 1983). Major sucking insect pests recorded on cotton are thrips, *Thrips tabaci*; whitefly, *Bemisia tabaci*; leafhopper, *Amrasca biguttula biguttula*; aphids, *Aphis gossypii*; red cotton bug, *Dysdercus koenigii* and leaf beetle, *Cerotoma trifurcate* (Ashfaq et al., 2011). The insects can damage cotton to the tune of 39.50% (Naqvi, 1975; Chaudhry, 1976).

*Bemisia tabaci* has become one of the most important sucking pest of world's industrial and food crops like cotton,

sunflower, melon, tomato, brinjal etc. (Anonymous, 1986; Greathead, 1986). Heavy infestation may reduce plant vigor and growth, cause chlorosis and uneven ripening of bolls. Its direct feeding induces physiological disorders resulting in shedding of immature fruiting parts. Its nymphs produce honeydew, on which black sooty mold grows, reducing the photosynthetic capabilities of plants. This situation results in stunting of plants and lint contamination. It acts as a sole vector of more than 100 plant viruses, which cause diseases to many commercial crops in different parts of the world (Jones, 2003). It also transmits cotton leaf curl virus disease, a real threat to cotton production in Pakistan.

*Thrips tabaci* damages immature cotton seedlings, flowers and stems. In the beginning of the season attack is severe because of low relative humidity. After its attack leaves of seedlings become wrinkled and distorted, and the vegetative phase is delayed leading to late harvest of the crop causing higher losses not only to the farmer but also to the country's economy.

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Trips are slender in shape and the color of adults varies from pale yellow to dark brown. Antennae are seven segmented with the first segment always paler than second segment which is usually dark. Pupation occurs in the soil. These are usually active round the year moving from one host to another. Heavy rainfall limits the thrips population. Systemic insecticides such as seed treatment or sprays offer protection to crop at earlier stages of crop growth (Colyer et al., 1991).

Large quantity of broad-spectrum insecticides is used to control key pests of cotton which are responsible for not only health problems and environmental pollution but become the main reason of insecticidal resistance development against insect pests (Mohyuddin et al., 1997).

With the invention of transgenic cotton cultivars, broad-spectrum insecticides usage has become minimized to great extent. As a result, non-target sucking insect pests of cotton which includes whitefly, thrips, aphids, leaf bugs and spider mites survive better (Xu et al., 2008) and feed on their host more comfortably.

So, there is a dire need to sort out or screen out new cotton lines/varieties relatively resistant to sucking insect pests and mites to fulfill the fiber demands of the population increasing at an alarming rate of 2.9% (Ghafoor et al., 2011).

The current research work was conducted to check the performance of both transgenic and conventional cotton cultivars and study the population dynamics of *B. tabaci* and *T. tabaci* incidence.

## Materials and Methods

The present research was carried out to assess the performance of two transgenic cotton cultivars (FH-114 and FH-901) and two conventional cotton cultivars (FH-1000 and CIM-496) against the population dynamics of *Bemisia tabaci* and *Thrips tabaci* at University of Agriculture, Faisalabad, Pakistan during 2012. The experiment was laid out under Randomized Complete Block Design (RCBD) having three replications. The plot size was 30×70 feet for each treatment. All possible agronomic practices were carried out to reduce the influence of weeds and alternate hosts of the pests. No plant protection measures, including pesticide application were applied.

The population of *B. tabaci* and *T. tabaci* was recorded from 24-June-2012 to 29-July-2012. Mario method was used in sample for pest scouting (Carolyn et al., 2004). Data was collected by selecting ten plants randomly, from each replication. Population of *B. tabaci* and *T. tabaci* were recorded from upper leaf (first plant), middle leaf (second plant), lower leaf (third plant) and so on. The data were recorded fortnightly, for six weeks, continuously.

Standard procedure was followed to record the data. The data collected was analyzed statistically by applying Fisher's analysis of variance technique and least significant difference test will be applied at 5% probability level to test the significance of the treatment means.

## Results

### Population dynamics of *Bemisia tabaci* on transgenic and conventional cotton cultivars on different dates during 2012

#### *Population recorded during 24-06-2012*

Maximum population was recorded on FH-114 (5.29 *B. tabaci*/leaf) followed by FH-901 (5.24 *B. tabaci*/leaf) while minimum population was recorded on CIM-496 (3.81 *B. tabaci*/leaf) followed by FH-1000 (3.82 *B. tabaci*/leaf) during 24-06-2012 (Figure 1).

#### *Population recorded during 01-07-2012*

Maximum population was recorded on FH-114 (5.36 *B. tabaci*/leaf) followed by FH-901 (5.31 *B. tabaci*/leaf) while minimum population was recorded on CIM-496 (3.84 *B. tabaci*/leaf) followed by FH-1000 (3.87 *B. tabaci*/leaf) during 01-07-2012 (Figure 1).

#### *Population recorded during 08-07-2012*

Maximum population was recorded on FH-114 (5.18 *B. tabaci*/leaf) followed by FH-901 (5.15 *B. tabaci*/leaf) while minimum population was recorded on CIM-496 (3.73 *B. tabaci*/leaf) followed by FH-1000 (3.75 *B. tabaci*/leaf) during 08-07-2012 (Figure 1).

#### *Population recorded during 15-07-2012*

Maximum population was recorded on FH-114 (5.08 *B. tabaci*/leaf) followed by FH-901 (5.03 *B. tabaci*/leaf) while minimum population was recorded on FH-1000 (3.6 *B. tabaci*/leaf) followed by CIM-496 (3.67 *B. tabaci*/leaf) during 15-07-2012 (Figure 1).

#### *Population recorded during 22-07-2012*

Maximum population was recorded on FH-114 (5.21 *B. tabaci*/leaf) followed by FH-901 (5.19 *B. tabaci*/leaf) while minimum population was recorded on CIM-496 (3.77 *B. tabaci*/leaf) followed by FH-1000 (3.79 *B. tabaci*/leaf) during 22-07-2012 (Figure 1).

#### *Population recorded during 29-07-2012*

Maximum population was recorded on FH-114 (5.11 *B. tabaci*/leaf) followed by FH-901 (5.07 *B. tabaci*/leaf) while

minimum population was recorded on CIM-496 (3.69 *B. tabaci*/leaf) followed by FH-1000 (3.72 *B. tabaci*/leaf) during 29-07-2012 (Figure 1).

#### Mean comparison of Bemisia tabaci population on transgenic and conventional cotton cultivars on different dates during 2012

The results revealed that the highest mean population of *B. tabaci* was observed on transgenic cotton cultivar, FH-114 (5.21 *B. tabaci*/leaf) while minimum mean popu-

lation was recorded on conventional cotton cultivar, CIM-496 (3.75 *B. tabaci*/leaf) on different dates during 2012 (Figure 3).

#### Mean comparison (pooled) of Bemisia tabaci population on transgenic and conventional cotton cultivars on different dates during 2012

The pooled analysis of *B. tabaci* population on transgenic and conventional cotton cultivars revealed that transgenic cultivars had higher population level (5.19 *B. tabaci*/leaf)

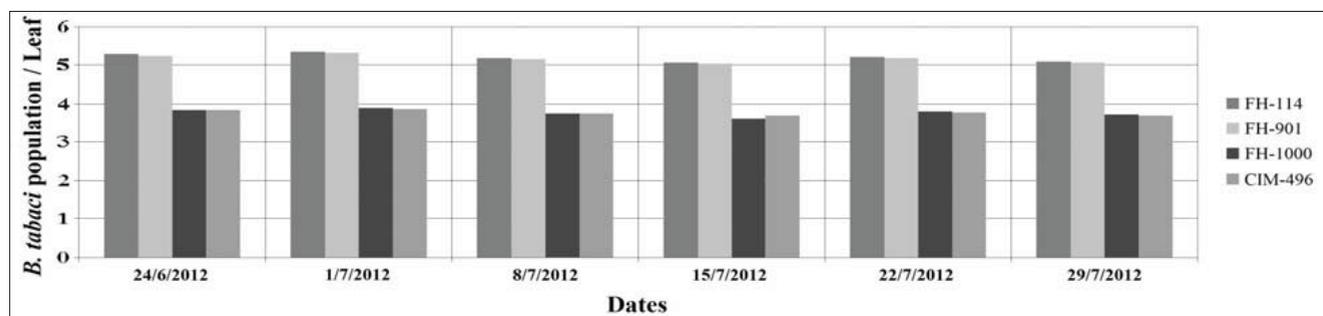


Fig. 1. Performance of cotton cultivars against population fluctuation of Bemisia tabaci on different dates during 2012

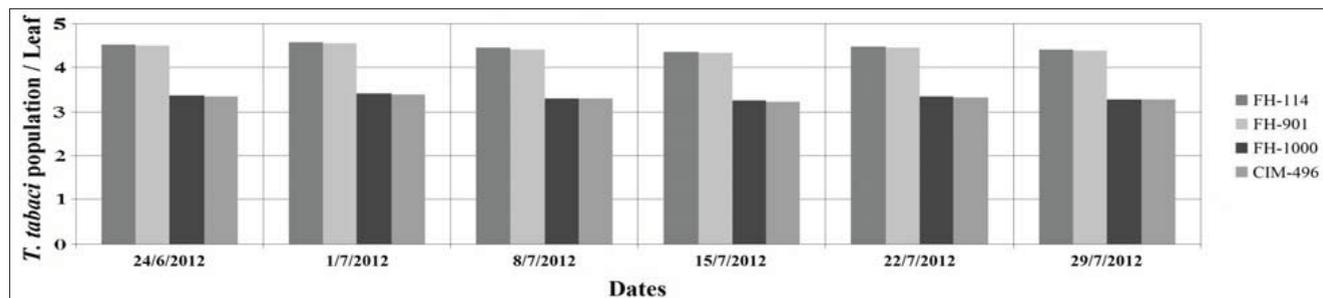


Fig. 2. Performance of cotton cultivars against population fluctuation of Thrips tabaci on different dates during 2012

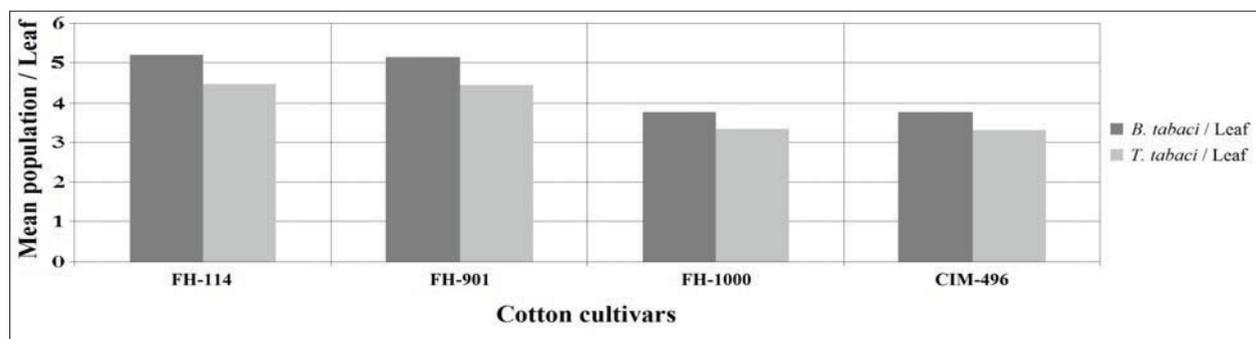
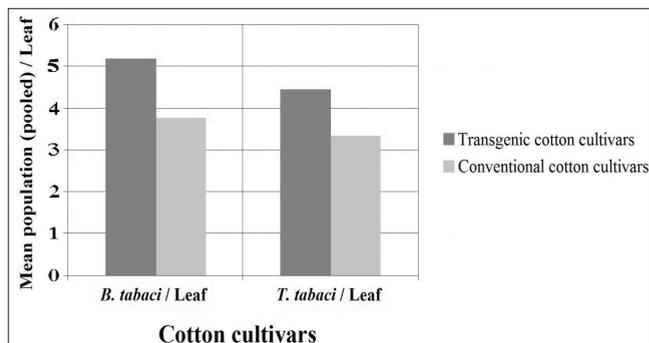


Fig. 3. Mean population of Bemisia tabaci and Thrips tabaci on cotton cultivars on different dates during 2012



**Fig. 4. Mean population (pooled) of *Bemisia tabaci* and *Thrips tabaci* on cotton cultivars on different dates during 2012**

while conventional cultivars had lowest population level (3.76 *B. tabaci*/leaf) on different dates during 2012 (Figure 4).

#### **Population dynamics of *Thrips tabaci* on transgenic and conventional cotton cultivars on different dates during 2012**

##### **Population recorded during 24-06-2012**

Maximum population was recorded on FH-114 (4.53 *T. tabaci*/leaf) followed by FH-901 (4.51 *T. tabaci*/leaf) while minimum population was recorded on CIM-496 (3.35 *T. tabaci*/leaf) followed by FH-1000 (3.38 *T. tabaci*/leaf) during 24-06-2012 (Figure 2).

##### **Population recorded during 01-07-2012**

Maximum population was recorded on FH-114 (4.57 *T. tabaci*/leaf) followed by FH-901 (4.55 *T. tabaci*/leaf) while minimum population was recorded on CIM-496 (3.4 *T. tabaci*/leaf) followed by FH-1000 (3.43 *T. tabaci*/leaf) during 01-07-2012 (Figure 2).

##### **Population recorded during 08-07-2012**

Maximum population was recorded on FH-114 (4.45 *T. tabaci*/leaf) followed by FH-901 (4.42 *T. tabaci*/leaf) while minimum population was recorded on CIM-496 (3.3 *T. tabaci*/leaf) followed by FH-1000 (3.31 *T. tabaci*/leaf) during 08-07-2012 (Figure 2).

##### **Population recorded during 15-07-2012**

Maximum population was recorded on FH-114 (4.37 *T. tabaci*/leaf) followed by FH-901 (4.35 *T. tabaci*/leaf) while minimum population was recorded on FH-1000 (3.24 *T. tabaci*/leaf) followed by CIM-496 (3.26 *T. tabaci*/leaf) during 15-07-2012 (Figure 2).

##### **Population recorded during 22-07-2012**

Maximum population was recorded on FH-114 (4.49 *T. tabaci*/leaf) followed by FH-901 (4.47 *T. tabaci*/leaf) while minimum population was recorded on CIM-496 (3.32 *T. tabaci*/leaf) followed by FH-1000 (3.36 *T. tabaci*/leaf) during 22-07-2012 (Figure 2).

##### **Population recorded during 29-07-2012**

Maximum population was recorded on FH-114 (4.41 *T. tabaci*/leaf) followed by FH-901 (4.39 *T. tabaci*/leaf) while minimum population was recorded on CIM-496 (3.27 *T. tabaci*/leaf) followed by FH-1000 (3.29 *T. tabaci*/leaf) during 29-07-2012 (Figure 2).

#### **Mean comparison of *Thrips tabaci* population on transgenic and conventional cotton cultivars on different dates during 2012**

The results revealed that the highest mean population of *T. tabaci* was observed on transgenic cotton cultivar, FH-114 (4.47 *T. tabaci*/leaf) while minimum mean population was recorded on conventional cotton cultivar, CIM-496 (3.31 *T. tabaci*/leaf) on different dates during 2012 (Figure 3).

#### **Mean comparison (pooled) of *Thrips tabaci* population on transgenic and conventional cotton cultivars on different dates during 2012**

The pooled analysis of *T. tabaci* population on transgenic and conventional cotton cultivars revealed that transgenic cultivars had higher population level (4.46 *T. tabaci*/leaf) while conventional cultivars had lowest population level (3.33 *T. tabaci*/leaf) on different dates during 2012 (Figure 4).

## **Discussion**

The results revealed that maximum populations of *B. tabaci* and *T. tabaci* were recorded on transgenic cotton cultivars (FH-114 and FH-901) while minimum populations were recorded on conventional cotton cultivars (FH-1000 and CIM-496). Maximum mean population of *B. tabaci* (5.36 *B. tabaci*/leaf) and *T. tabaci* (4.57 *T. tabaci*/leaf) were observed on FH-114 during 01-07-2012, while low mean level of infestation of *B. tabaci* (3.6 *B. tabaci*/leaf) was observed on FH-1000 during 15-07-2012 and low mean level of *T. tabaci* infestation (3.24 *T. tabaci*/leaf) were observed on CIM-496 during 15-07-2012.

However, previously reported studies by Jeyakumar et al. (2008) had shown higher incidence of *B. tabaci* in transgenic cotton hybrids. This was, however, probably due to limited or no feeding by bollworms and not because of higher *B. tabaci* sus-

ceptibility (Wilson et al., 1992). Akram et al. (2013) found during study that transgenic genotypes were more susceptible host for the *B. tabaci* and *T. tabaci* than conventional genotypes.

Results are also in accordance with Atta et al. (2015). They conducted an experiment to assess the performance of transgenic and conventional cotton cultivars in response to population dynamics of *B. tabaci*. On the numerical basis, results revealed that transgenic cotton cultivars were more susceptible to *B. tabaci* infestation as compared to conventional cotton cultivars.

Raza et al. (2015) reported that transgenic cultivars were more susceptible to *T. tabaci* infestation as compared to conventional genotypes. Highest population of ladybird beetles was observed on transgenic cultivars as compared to conventional genotype due to more availability of *T. tabaci* which act as a food source for ladybird beetles.

## Conclusions

In the light of above mentioned results and numerical data, it is concluded that transgenic cotton cultivars were more susceptible to *B. tabaci* and *T. tabaci* infestation as compared to traditional cotton cultivars. Maximum *B. tabaci* and *T. tabaci* populations were observed on FH-114, whereas low level of infestation of *B. tabaci* and *T. tabaci* were observed on CIM-496. When data were statistically analyzed, *B. tabaci* and *T. tabaci* population on transgenic and conventional cotton cultivars revealed that transgenic cotton cultivars had higher level of *B. tabaci* and *T. tabaci* compared to traditional cotton cultivars. Need of the time is to screen out new cotton lines/varieties which are relatively resistant to sucking insect pests.

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